

Breeding habits and associated phenomena in some Indian bats

Part III—*Hipposideros ater ater* (Templeton)—Hipposideridae¹

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The study is based on the examination of 419 specimens of *Hipposideros ater ater* (Templeton) collected at frequent intervals from deep wells in Marathwada region, Maharashtra, India, for a period of two years from February 1965 to the end of February 1967 so that every calendar month is represented by one collection or more. A colony consists of 200 to 300 individuals. There is a sharply defined breeding season. All females in the colony become pregnant between mid-November and mid-December, and the young are delivered, one by each female, during the last week of May and end June after a gestation of 190 to 200 days. The young are carried by the mothers for about 25 days after which they become free, but visit the mother for suckling for a few more days. The growth is rapid during the suckling period and the young reach nearly the adult size. Sexual maturity is attained by the females within the year of birth. There is an abnormal sex ratio in the total population with the females outnumbering the males, although the sex ratio is even at birth. The uterus is bicornuate, but the left side is physiologically dominant over the right in bearing pregnancy.

INTRODUCTION

There is no detailed work so far on the breeding biology of any member of the family Hipposideridae, and the little information, which is available, is in the nature of casual references to the occurrence of pregnant specimens in one or a few random collections made by workers while they were studying some other aspect of the life of these animals (Blanford 1891; Matthews 1941; Gopalakrishna 1958; Gopalakrishna & Moghe 1960; Brosset 1962; Asdell 1964). Recently Menzies (1973) noted that *Hipposideros caffer* from north-west Nigeria undergoes copulation in November and delivers the young at the end of the following April or early May after a gestation period of about 5 months. He also noted that the females breed within the year of their birth.

The paucity of information on the reproduction of the hipposiderid bats encouraged us to undertake detailed investigations on the breeding biology of members of this family. This paper embodies observations on the female reproductive cycle of *Hipposideros ater ater*.

MATERIAL AND METHODS

The specimens of *Hipposideros ater ater* were collected from Dongerkheda, Barad and Shirol in Marathwada region, Maharashtra. The collection work was started on 10th February 1965 and continued until 25th February 1967 in such a manner that every calendar month is represented by one collection or more. Altogether 419 specimens were collected and examined for the present report.

Hipposideros ater ater is usually found within the dark hollows in the walls of wells. The presence of these bats in the well can be detected by the characteristic odour emanating from the

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well. These bats are active and can be often seen fluttering about in the well even during the day time. They come out into the open late in the evening. They are very delicate, and a highly humid atmosphere is very essential for their survival. Each well, from which these specimens were obtained, contained two to three hundred specimens, and there was no segregation of the specimens on the basis of age, sex or season.

This is a comparatively small bat with an average body weight of 5 to 6 gm, fore-arm length of 34 to 38 mm and the wing span of about 230 mm. The fur is dark grey on the dorsal side and greyish-white on the ventral side. The specimens were captured with the help of butterfly nets, and killed with chloroform. Their body weights were recorded immediately. The condition of the external genitalia and accessory structures were noted, and a complete collection diary was maintained. The reproductive organs and accessory reproductive structures were dissected out and fixed in Bouin's fluid for 24 hours and preserved in 70% ethanol. The tissues were dehydrated by passing through graded ethanol, embedded in paraffin and sectioned at 10 μ thickness. Most of the sections were stained with Ehrlich's haematoxylin and counterstained with eosin and mounted in Canada balsam after clearing in xylol.

The specimens collected on a given calendar date presented almost the same condition during the two years when the collections were made. Table I gives the summary of the collection diary, and table II gives the monthwise distribution of the specimens collected.

OBSERVATIONS AND CONCLUSIONS

1. General remarks

Although this species has a bicornuate uterus like most bats, only one cornu bears a single conceptus during each pregnancy. The un-

weaned young normally cling to the mothers in the head-to-tail position holding one of the pubic dugs of the mother by its teeth and hooking the claws of the toes to the fur or the neck of the mother. The young reverses itself while sucking milk. The free flying young remain in the colony and continue to suck milk from their mothers. Apparently there is community suckling of the young for some time after the young become independent.

The mammary glands are pectoral in position and are present on the ventro-lateral aspect of the thorax, one on each side. The mammary nipples are directed laterally. There is a pair of pubic dugs without mammary glands, one on each side in the inguinal region. The mammary nipples and pubic dugs are insignificant in size during juvenile life, but become enlarged during the first pregnancy and lactation and remain as such during the rest of the life of the animal.

2. Breeding habits

Hipposideros ater ater has an annual reproductive cycle and breeds in a sharply restricted season. These conclusions are based on the following facts. Examination of the collection diary and table I reveals that pregnancy, as evidenced by the occurrence of a bulbous uterine cornu, is noticed only from about the last week of November to about the last week of June. Two females, each carrying a young at the breast, were collected on 24th May. The mothers' uteri were still in the post-partum stage, and the young ones at their breast had each a fresh umbilical stub and closed eye lids. Each of them weighed 1.5 gm, which is also the weight of the full term foetus. These facts indicate that the young ones had been delivered a few hours earlier. During the following weeks there were progressively more females in the colony which had delivered their young. Two pregnant females collected on 24th June had full term foetuses, which, gauging from their

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TABLE I

SUMMARY OF COLLECTION DIARY

Date	Male				Female							Grand total	
	Immature		Adult	Total	Immature		Non-pregnant	Adult					
	Attached	Free			Attached	Free		pregnant		Lactating	Total		
			Right horn	Left horn									
1	2	3	4	5	6	7	8	9	10	11	12	13	
5-1-66	5	5	..	..	1	2	7	..	10	15
6-1-67	2	2	..	..	..	..	8	..	8	10
15-1-66	2	2	..	..	..	..	6	..	6	8
19-1-67	2	2	..	..	..	3	3	..	6	8
28-1-66	1	..	1	1
10-2-65	8	8	..	..	2	4	6	..	12	20
12-2-66	3	3	..	..	..	2	11	..	13	16
16-2-65	4	4	..	..	1	4	6	..	11	15
23-2-66	4	4	..	..	1	..	10	..	11	15
28-2-67	4	4	..	..	..	5	4	..	9	13
2-3-65	5	5	..	..	..	3	4	..	7	12
7-3-65	7	7	..	..	1	3	3	..	7	14
12-3-65	4	6	..	10	10
15-3-66	1	1	..	..	..	2	8	..	10	11
17-3-65	6	6	..	..	1	4	7	..	12	18
17-3-66	2	2	..	..	1	5	..	..	6	8
24-3-66	3	3	..	..	..	2	3	..	5	8
7-4-65	1	1	..	..	..	..	8	..	8	9
9-5-65	6	6	..	..	..	7	7	..	14	20
24-5-66	2	..	..	2	2	2	8	8
29-5-65	2	2	1	..	..	1	3	1	6	8
29-5-66	1	1	..	..	..	3	..	..	3	4
11-6-65	..	3	..	1	4	3	..	..	..	..	5	8	12
18-6-65	..	2	1	..	3	3	4	..	..	1	10	18	21
24-6-66	..	6	1	2	9	1	2	..	1	1	11	16	25
15-7-65	3	2	5	..	3	2	..	..	3	8	13
15-8-65	4	2	6	..	1	2	..	..	5	8	14
27-9-65	2	2	..	..	4	..	..	..	4	6
25-10-65	9	9	..	..	9	..	..	..	9	18
23-11-65	7	7	..	..	..	2	8	..	10	17
28-11-66	2	2	..	..	2	..	7	..	9	11
22-12-65	3	3	..	..	..	2	6	..	8	11
24-12-65	5	5	..	..	..	..	2	..	2	7
25-12-65	1	1	..	..	..	..	1	..	1	2
25-12-66	1	1	..	..	2	3	5	..	10	11

TABLE II
MONTHWISE DISTRIBUTION OF SPECIMENS

Month		Male	Female	Total
Jan.	..	11	31	42
Feb.	..	23	56	79
Mar.	..	24	57	81
Apr.	..	1	8	9
May	..	9	31	40
Jun.	..	16	42	58
Jul.	..	5	8	13
Aug.	..	6	8	14
Sep.	..	2	4	6
Oct.	..	9	9	18
Nov.	..	9	19	28
Dec.	..	10	21	31
Total	..	125	294	419

size, weight and the stage of development, would have been delivered in a day or two. No pregnant female was collected after this date. Evidently, this species has a long gestation period of about 190 to 200 days—calculating from about a week prior to the date when the first sign of pregnancy was noticed (23rd November) to the date on which the first delivered young were collected (24th May), and allowing a margin of a couple of days on either side.

The suckling young are constantly carried by their mothers at the breast. The first group of young ones, which had become free from their mothers, was collected on 18th June. Assuming that these were the young delivered in the first batch (that is, around 24th May), it is evident that the young are carried by their mothers for about 25 days. However, suckling of the young continues for some time after the young leave their mothers as indicated by the fact that the mammary glands of the mothers continued to be in full lactation until August and curdled milk was present in the stomach of several free flying young.

From the foregoing account of the breeding habits of the females of *Hipposideros ater ater* the annual life of the adult female of this species can be recognized into the following periods :—

- (1) period of sexual quiescence from about the middle of August to about the second week of November.
- (2) Copulation in about the second week of November.
- (3) Pregnancy from about the middle of November until the last week of June.
- (4) Parturition during the last week of May to the end of June.
- (5) Lactation from about the last week of May until about the middle of August.
- (6) Neither the commencement of pregnancy nor parturition take place

synchronously in all the females in the colony. There is a span of about 30 days (between 15th November and 15th December), when all the females become pregnant, and there is similarly a span of 30 days (between 24th May and 24th June) when all deliveries occur.

(3) Number of young and symmetry of genitalia

Out of the 208 pregnant specimens collected, 144 had the pregnancy in the left cornu and 64 in the right. Microscopic examination of the ovaries of the pregnant females revealed that the corpus luteum was present invariably on the same side in which the uterine cornu carried the conceptus. It is not possible to determine if there is any alternation of the pregnancies between the two sides of the genitalia in successive cycles in this species. On the other hand it is very unlikely that there is such an alternation of the two sides of the genitalia in successive cycles as borne out by the following facts :— Pregnancies occurred on the left side more than on the right side during all the three successive breeding seasons when the collections were made. For example in 1965, 67 females had pregnancy in the left side and 34 in the right ; in 1966, 62 had pregnancy in the left side and 22 in the right ; in 1967 (collections made only during January and February), 15 had pregnancies in the left side and 8 in the right side. If physiological alternation occurs between the two sides of the genitalia, then the proportion of the pregnancies on the two sides should also alternate between the two sides in successive years. Evidently, there is a natural dominance of the left side of the genitalia in *Hipposideros ater ater*. The factors responsible for this are not known.

(4) Growth and maturity

Mention has already been made that the young ones are all delivered between the last

TABLE III
DISTRIBUTION OF FEMALES DURING THE BREEDING SEASON

Date	Pregnant		Non-pregnant	
	with mammary nipples and pubic teats	without mammary nipples and pubic teats	with mammary nipples and pubic teats	without mammary nipples and pubic teats
1	2	3	4	5
5-i-66 ..	8	1	1	..
6-i-67 ..	3	5	..	..
15-i-66 ..	6	..	..	..
19-i-67 ..	6	..	..	..
28-i-66 ..	1	..	..	..
10-ii-65 ..	9	1	1	1
12-ii-66 ..	11	2	..	..
16-ii-65 ..	9	1	..	1
23-ii-66 ..	8	2	..	1
28-ii-67 ..	7	2	..	..
2-iii-65 ..	6	1	..	..
7-iii-65 ..	6	..	..	1
12-iii-65 ..	7	3	..	..
15-iii-66 ..	3	7	..	..
17-iii-65 ..	8	3	1	..
17-iii-66 ..	4	1	..	..
24-iii-66 ..	4	1	..	..
7-iv-65 ..	8	..	..	..
9-v-65 ..	14	..	..	..
24-v-66 ..	4	..	..	..
29-v-65 ..	4	..	..	..
29-v-66 ..	3	..	..	..
11-vi-65 ..	..	..	..	..
18-vi-65 ..	1	..	..	..
24-vi-66 ..	2	..	..	..
15-vii-65 ..	..	..	2	..
15-viii-65 ..	..	..	1	1
27-ix-65 ..	..	..	4	..
25-x-65 ..	..	..	5	4
23-xi-65 ..	9	1	..	..
28-xi-66 ..	7	..	1	1
22-xii-65 ..	7	1	..	..
24-xii-65 ..	2	..	..	..
25-xii-65 ..	1	..	..	..
25-xii-66 ..	7	1	1	1
Total ..	175	33	17	11

week of May and the last week of June. The new-born young weighs about 1.5 gm (the highest weight of the foetus is also about 1.5 gm). Immediately after birth the young one attaches itself to the breast of the mother, and is carried by the mother until it attains a body weight of about 3.5 gm, after which it leaves the mother, although it may continue to suck for a few more days. The first batch of independent young weighing 3.5 gm was collected on 18th June. It has already been mentioned that the young one is carried constantly by the mother for about 25 days. During this period the young one increases rapidly in weight from 1.5 gm to 3.5 gm. It is hardly possible to distinguish the weaned young from the adults on the basis of body size.

Table III shows the distribution of pregnant and non-pregnant females during the different months of the breeding season. Out of 220 females collected from November to June only 12 specimens were non-pregnant, and among the pregnant females 175 specimens had well-developed mammary nipples and pubic dugs and 33 had insignificant mammary nipples and pubic dugs. Among the 12 non-pregnant females 5 had well-developed mammary nipples, indicating that these are parous animals and the rest had insignificant mammary nipples and pubic dugs. The occurrence of very few

non-pregnant females (some unquestionably parous) during the breeding season must be accidental either due to missed copulation or due to abortion. From the foregoing it is evident that the females reach sexual maturity within the year of their birth when they attain an age of about 6 months.

(5) Sex ratio

Out of a total of 419 specimens collected at random during a period of two years there were 294 (70%) females and 125 (30%) males. 21 young ones collected from the breasts of the mothers included 11 males and 10 females, and 19 free young ones included 9 males and 10 females. Evidently, there is a balanced sex ratio at birth and during early life, but there appears to be a preferential mortality of the males during the growth period resulting in an uneven female-dominant sex ratio in the adult stage.

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